What is claimed is:

[Claim 1] A method of forming a gas dielectric structure for a semiconductor structure, the method comprising the steps of:

forming an opening for semiconductor structure in a dielectric layer on a substrate;

depositing a sacrificial layer over the opening;

performing a directional etch on the sacrificial layer to form a sacrificial layer sidewall on the opening;

depositing a conductive liner over the opening;

depositing a metal in the opening;

planarizing the metal and the conductive liner;

removing the sacrificial layer sidewall to form a void; and

depositing a cap layer over the void to form the gas dielectric structure.

[Claim 2]

The method of claim 1, wherein the opening includes at least one wiring line opening and at least one via.

[Claim 3] The method of claim 2, wherein the void extends along a side of the at least one via.

[Claim 4] The method of claim 1, wherein the forming step includes performing a dual damascene process.

[Claim 5] The method of claim 1, wherein the forming step includes depositing a hard mask, patterning the hard mask and etching the hard mask.

[Claim 6] The method of claim 1, further comprising the step of depositing a non-conductive liner prior to the step of depositing the sacrificial layer.

[Claim 7] The method of claim 1, wherein the conductive liner includes at least one of the group consisting of: tantalum (Ta), tantalum nitride (TaN), titanium (Ti), titanium nitride (TiN), tungsten (W) and niobium (Nb).

[Claim 8] The method of claim 1, wherein the sacrificial layer includes one of the group consisting of: aluminum (Al), silicon dioxide (SiO_2) and titanium (Ti).

[Claim 9] The method of claim 1, wherein the removing step includes etching the sacrificial sidewall layer using one of: a) water (H_2O) and sodium hydroxide (NaOH); b) water (H_2O) and hydrofluoric acid (HF); and c) hydrofluoric acid (HF) and hydrochloric acid (HCl).

[Claim 10] The method of claim 9, wherein in the case that water (H_2O) and sodium hydroxide (NaOH) are used as an etchant, the ratio of H_2O to NaOH is no greater than approximately 10:1 and no less than 1:1.

[Claim 11] A method of forming a gas dielectric structure for a semiconductor structure, the method comprising the steps of:

performing a dual damascene process to form an opening including at least one wiring opening and at least one via in a dielectric layer on a substrate;

depositing a sacrificial layer over the opening;

performing a directional etch on the sacrificial layer to form a sacrificial layer sidewall;

depositing a conductive liner over the opening;

depositing a metal in the opening;

planarizing the metal and the conductive liner;

removing the sacrificial layer sidewall to form a void; and

depositing a cap layer over the void to form the gas dielectric structure.

[Claim 12] The method of claim 11, wherein the void extends along a side of the at least one via.

[Claim 13] The method of claim 11, wherein the forming step includes depositing a hard mask, patterning the hard mask and etching the hard mask.

[Claim 14] The method of claim 11, further comprising the step of depositing a non-conductive liner prior to the step of depositing the sacrificial layer, wherein the non-conductive liner includes one of the group consisting of: silicon nitride (Si_3N_4) and silicon dioxide (SiO_2).

[Claim 15] The method of claim 11, wherein the conductive liner includes at least one of the group consisting of: tantalum (Ta), tantalum nitride (TaN), titanium (Ti), titanium nitride (TiN), tungsten (W) and niobium (Nb).

[Claim 16] The method of claim 11, wherein the sacrificial layer includes one of the group consisting of: aluminum (Al), silicon dioxide (SiO_2) and titanium (Ti).

[Claim 17] A method of forming a gas dielectric structure for a semiconductor structure, the method comprising the steps of:

performing a via-first dual damascene process to form an opening including at least one wiring opening and at least one via in a dielectric layer on a substrate;

depositing a sacrificial layer over the opening;

performing a directional etch on the sacrificial layer to form a sacrificial layer sidewall;

depositing a conductive liner over the opening;

depositing a metal in the opening;

planarizing the metal and the conductive liner;

removing the sacrificial layer sidewall to form a void that extends along a side of the at least one via; and

depositing a cap layer over the void to form the gas dielectric structure.

[Claim 18] The method of claim 17, further comprising the step of depositing a non-conductive liner prior to the step of depositing the sacrificial layer, wherein the non-conductive liner includes one of the group consisting of: silicon nitride (Si_3N_4) and silicon dioxide (SiO_2).

[Claim 19] The method of claim 17, wherein the conductive liner includes one of the group consisting of: tantalum (Ta), tantalum nitride (TaN), titanium (Ti), titantium nitride (TiN), tungsten (W) and niobium (Nb).

[Claim 20] The method of claim 17, wherein the sacrificial layer includes one of the group consisting of: aluminum (Al), silicon oxide (SiO_2) and titanium (Ti).